CLAIMS

Please cancel all claims and replace with the following new claims:

36. An optical system for detecting contaminants and defects on a test surface comprising:

a device providing a light beam along a path to the test surface, producing an illuminated spot thereon;

a first and a second array of detectors;

a first collector having an optical axis substantially along a line perpendicular to the test surface, said first collector collecting light scattered by the surface and conveying the collected light to the first array of detectors;

a second collector having an optical axis substantially along the line, said second collector collecting light scattered by the surface and conveying the collected light to the second array of detectors, wherein the first and second collector collect light scattered by the surface within different ranges of collection angles from the line; and

an instrument causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

37. The optical system of claim 36, wherein the first and/or the second collector is substantially rotationally symmetrical about its optical axis.

38. The optical system of claim 37, wherein the first and/or the second collector collects light rotationally symmetrically about its optical axis.

39. The optical system of claim 36, wherein the device comprises a polarizer.

40. The optical system of claim 36, wherein the device provides a linearly or circularly polarized beam.

41. The optical system of claim 36, wherein the collectors comprise an ellipsoidal mirrored surface.

42. The optical system of claim 41, said ellipsoidal mirrored surface having two foci, wherein the mirrored surface is placed with said illuminated spot substantially at one of the two foci.

43. The optical system of claim 41, further comprising a detector aperture, said ellipsoidal mirrored surface having two foci, wherein the mirrored surface is placed with one of the two foci substantially at said detector aperture.

44. The optical system of claim 36, wherein the collectors comprise a lens assembly.

45. The optical system of claim 36, further comprising at least one lens positioned in the path of the beam to vary the size of the spot.

46. The optical system of claim 36, further comprising a detector aperture.

47. The optical system of claim 36, said illuminated spot being less than 50 microns in dimensions.

48. The optical system of claim 36, further comprising means for selecting passing scattered light having a predetermined range of scattering angles.

49. The optical system of claim 36, said device comprising means for placing the beam in a linear or circular state of polarization.

50. The system of claim 36, said device comprising at least one beam expander for shaping and focusing the light beam and at least one illumination aperture.

51. The system of claim 36, the detectors in said two detector arrays having different intensity detection thresholds.

52. The system of claim 36, wherein the first collector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line, and the second collector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

53. The system of claim 36, said system further comprising a third detector array, said three detector arrays located to detect light scattered by the surface within at least a first, second and third range of collection angles from the line, said first range of angles being about 3 to 25 degrees, and said second range being about 25 to 65 degrees, and said third range being about 65 to 85 degrees.

54. The system of claim 36, wherein the beam is polarized and the path is at an oblique angle to the test surface.

55. The system of claim 36, wherein the path is substantially normal to the test surface.

56. The system of claim 36, the detectors in said two detector arrays having intensity detection thresholds.

57. A optical method for detecting contaminants and defects on a test surface comprising:

providing a light beam along a path to the test surface, producing an illuminated spot thereon;

collecting light scattered by the surface within a first range of collection angles from the line and conveying the collected light to a first array of detectors by means of a first collector having an optical axis substantially along a line perpendicular to the test surface;

collecting light scattered by the surface within a second range of collection angles from the line different from the first range and conveying the collected light to a second array of detectors by means of a second collector having an optical axis substantially along the line; and

causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

58. The optical method of claim 57, wherein the collecting collects scattered light rotationally symmetrically about axes of the collectors.

59. The optical method of claim 57, wherein the providing comprises passing light from a source through a polarizer.

60. The optical method of claim 57, wherein the providing provides a linearly or circularly polarized beam.

61. The method of claim 57, wherein the collecting by the first collector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line, and the collecting by the second collector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

62. The method of claim 57, said method further comprising collecting by means of a third collector, said three collectors collecting light scattered by the surface within at least a first, second and third range of collection angles from the line, said first range of angles being about 3 to 25 degrees, and said second range being about 25 to 65 degrees, and said third range being about 65 to 85 degrees.

63. The method of claim 57, wherein the providing provides a polarized light beam along a path at an oblique angle to the test surface.

64. The method of claim 57, wherein the providing provides a light beam along a path at an oblique angle to the test surface.

a path at an oblique angle to the test surface.

65. The method of claim 57, wherein said method measures small anomalies in the presence of large anomalies on the test surface.

66. The method of claim 57, wherein said method enables differentiation between large and small anomalies.

67. The method of claim 57, wherein said method enables differentiation, characterization and/or classification of anomalies, said anomalies comprising scratches, slip lines, crystal originated particles and particles.

68. The method of claim 57, wherein said method enables differentiation between scratches, slip lines and crystal originated particles.

69. The method of claim 57, wherein said method enables differentiation between different topographic features.

70. An optical system for detecting contaminants and defects on a test surface comprising:

a device providing a polarized light beam along a path at an oblique angle to the test surface, producing an illuminated spot thereon;

a first and a second detector;

a first collector having an optical axis substantially along a line perpendicular to the test surface, said first collector collecting light scattered by the surface and conveying the collected light to the first detector; and

a second collector collecting light scattered by the surface and conveying the collected light to the second detector, wherein the first and second collectors collect light scattered by the surface within different ranges of collection angles from the line.

71. An optical system for detecting contaminants and defects on a test surface comprising:

a device providing a polarized light beam along a path at an oblique angle to the test surface, producing an illuminated spot thereon;

a first and a second detector;

a first collector collecting light scattered by the surface in a direction substantially normal to the test surface and conveying the collected light to the first detector; and

a second collector collecting light scattered by the surface and conveying the collected light to the second detector, wherein the first and second collectors collect light scattered by the surface within different ranges of collection angles from a line normal to the test surface.

72. The system of claim 71, wherein the first collector collects light scattered from the spot within collection angles of up to 25 degrees from the line.

73. The system of claim 71, wherein the first collector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line.

74. The system of claim 71, wherein the second collector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

75. The system of claim 71, said system further comprising a third detector, said three detectors located to detect light scattered by the surface within at least a first, second and third range of collection angles from the line, said first range of angles being about 3 to 25 degrees, and said second range being about 25 to 65 degrees, and said third range being about 65 to 85 degrees.

76. The system of claim 71, said system further comprising an instrument causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

77. The optical system of claim 71, wherein the device provides a linearly polarized beam.

78. The system of claim 71, said first collector having an optical axis substantially along a line perpendicular to the test surface.

79. An optical system for detecting contaminants and defects on a test surface comprising:

a device providing a polarized light beam along a path at an oblique angle to the test surface, producing an illuminated spot thereon;

a first and a second detector;

a first collector collecting light scattered by the surface within a first range of collection angles that includes a light scattering direction substantially normal to the test surface, said first collector conveying the collected light to the first detector; and

a second collector collecting light scattered by the surface and conveying the collected light to the second detector, wherein the second collector collects light scattered by the surface within a second range of collection angles that are different from the first range of collection angles.

80. The system of claim 79, wherein the first collector collects light scattered from the spot within collection angles of up to 25 degrees from the line.

81. The system of claim 79, wherein the first collector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line.

82. The system of claim 79, wherein the second collector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

83. The system of claim 79, said system further comprising a third detector, said three detectors located to detect light scattered by the surface within at least a first, second and third range of collection angles from the line, said first range of angles being about 3 to 25 degrees, and said second range being about 25 to 65 degrees, and said third range being about 65 to 85 degrees.

84. The system of claim 79, said system further comprising an instrument causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

85. The optical system of claim 79, wherein the device provides a linearly polarized beam.

86. The system of claim 79, said first collector having an optical axis substantially along a line perpendicular to the test surface.

87. An optical method for detecting contaminants and defects on a test surface comprising:

providing a polarized light beam along a path at an oblique angle to the test surface, producing an illuminated spot thereon;

collecting light scattered by the surface in a direction substantially normal to the test surface and conveying the collected light to a first detector; and

collecting light scattered by the surface and conveying the collected light to a second detector, wherein the first and second collectors collect light scattered by the surface within different ranges of collection angles from a line normal to the test surface.

88. The method of claim 87, wherein the collecting and conveying light to the first detector collects light scattered from the spot within collection angles of up to 25 degrees from the line.

89. The method of claim 87, wherein the collecting and conveying light to the first detector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line.

90. The method of claim 87, wherein the collecting and conveying light to the second detector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

91. The method of claim 87, said method further comprising causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

92. The optical method of claim 87, wherein the providing provides a linearly polarized beam.

93. The method of claim 87, wherein said method detects small anomalies in the presence of large anomalies on the test surface.

94. The method of claim 87, wherein said method enables differentiation between large and small anomalies.

95. The method of claim 87, wherein said method enables differentiation, characterization and/or classification of anomalies, said anomalies comprising scratches, slip lines, crystal originated particles and particles.

96. The method of claim 87, wherein said method enables differentiation between scratches, slip lines and crystal originated particles.

97. The method of claim 87, wherein said method enables differentiation between different topographic features.

98. An optical method for detecting contaminants and defects on a test surface comprising:

providing a polarized light beam along a path at an oblique angle to the test surface, producing an illuminated spot thereon;

collecting light scattered by the surface within a first range of collection angles that includes a light scattering direction substantially normal to the test surface, said first collector conveying the collected light to a first detector; and

collecting light scattered by the surface and conveying the collected light to a second detector, wherein the second collector collects light scattered by the surface within a second range of collection angles that are different from the first range of collection angles.

99. The method of claim 98, wherein the collecting and conveying light to the first detector collects light scattered from the spot within collection angles of up to 25 degrees from the line.

100. The method of claim 98, wherein the collecting and conveying light to the first detector collects light scattered from the spot within collection angles of about 3 to 25 degrees from the line.

101. The method of claim 98, wherein the collecting and conveying light to the second detector collects light scattered from the spot within collection angles of about 25 to 70 degrees.

102. The method of claim 98, said method further comprising causing relative rotational and translational motion between the beam and the surface, so that the beam scans a spiral path on the surface.

103. The optical method of claim 98, wherein the providing provides a linearly polarized beam.

104. The method of claim 98, wherein said method detects small anomalies in the presence of large anomalies on the test surface.

105. The method of claim 98, wherein said method enables differentiation between large and small anomalies.

106. The method of claim 98, wherein said method enables differentiation, characterization and/or classification of anomalies, said anomalies comprising scratches, slip lines, crystal originated particles and particles.

107. The method of claim 98, wherein said method enables differentiation between scratches, slip lines and crystal originated particles.

108. The method of claim 98, wherein said method enables differentiation between different topographic features.